Power and Efficiency

1. a. What is the output power of a 1400kg car that can accelerate from rest to 100.0km/h in 5.0s, neglecting resistive forces of air resistance and friction?

b. If the efficiency of the engine is 36%, how much energy was consumed by the car during the acceleration?

2. An elevator lifts 12 people, who, by some very strange coincidence, each have a mass of 64.0kg upward 24m. The elevator consumes 2.20x105J of electricity in doing so. What is the efficiency of the elevator?

3. An elevator lowers 12 people, who, by some very strange coincidence, each have a mass of 64.0kg downward 24m. The elevator consumes 2.20x105J of electricity in doing so. What is the efficiency of the elevator?

4. What is the power output of a 1200kg car travelling at a constant speed of 34.0m/s along level ground if the force of resistance (friction and drag) is 1.10x103N?

5. What is the power output of a 1200kg car travelling at a constant speed of 34.0m/s up a hill angled at 10.0o if the force of resistance is 1.10x103N?

6. a. The ferry to Victoria travels at a constant 11m/s and has a mass of 2.45 x 105kg. Assuming that there is a constant 5.0x105N frictional force (due to water resistance) how much work is done by the ferry’s engine on the 42km voyage? The trip takes 1.5hours.

b. What is the power of the ferry’s engine in horsepower? (1 horsepower = 746 Watts)

Power and Efficiency

1. a. What is the output power of a 1400kg car that can accelerate from rest to 100.0km/h in 5.0s, neglecting resistive forces of air resistance and friction?

b. If the efficiency of the engine is 36%, how much energy was consumed by the car during the acceleration?

2. An elevator lifts 12 people, who, by some very strange coincidence, each have a mass of 64.0kg upward 24m. The elevator consumes 2.20x105J of electricity in doing so. What is the efficiency of the elevator?

3. An elevator lowers 12 people, who, by some very strange coincidence, each have a mass of 64.0kg downward 24m. The elevator consumes 2.20x105J of electricity in doing so. What is the efficiency of the elevator?

4. What is the power output of a 1200kg car travelling at a constant speed of 34.0m/s along level ground if the force of resistance (friction and drag) is 1.10x103N?

5. What is the power output of a 1200kg car travelling at a constant speed of 34.0m/s up a hill angled at 10.0o if the force of resistance is 1.10x103N?

6. a. The ferry to Victoria travels at a constant 11m/s and has a mass of 2.45 x 105kg. Assuming that there is a constant 5.0x105N frictional force (due to water resistance) how much work is done by the ferry’s engine on the 42km voyage? The trip takes 1.5hours.

b. What is the power of the ferry’s engine in horsepower? (1 horsepower = 746 Watts)

7. A 500.0W (output) drill drives a screw into a piece of wood in 0.86s. The screw is 6.00cm long, has a pitch of 3.00mm and a shaft diameter of 2.00mm.

a. Find the work done by the drill.

b. Find the average force applied by the drill

c. If the drill is 80% efficient, how much electrical energy is consumed?

8. A pile driver is used to pound large posts into the ground during construction. It is a very simple device in which a large mass is dropped onto the top of the post, driving it into the ground. The mass is 1.00x103kg and it is dropped from a height of 5.00m. Upon hitting the post it drives the post down 10.0cm in 0.050s before coming to rest.

a. How much work must be done to lift the mass up 5.00m?

b. How much kinetic energy does the mass have at the moment it impacts the post?

c. How much kinetic energy does the mass have when it at rest?

d. How much power did the post-strike dissipate?

9. A 2019 Nissan GT-R has a mass of 1780kg. The GT-R can brake from 96.6km/h (60mph) to zero in 28m.

a. How much heat is generated by the brakes?

b. What is the power of the brakes?

c. Assuming that the 2 front brakes provide 70% of the stopping power, what is the average force provided by each of the four brakes?

10. a. How much electrical energy is consumed by a 100.0W light bulb in 1.00h if the efficiency is 40.0%?

b. How much light is produced by a 100.0W light bulb in 1.00h if the efficiency is 40.0%?

c. How much heat and sound is produced by a 100.0W light bulb in 1.0h if the efficiency is 40.0%?

11. Usein Bolt can run 100.0m in 9.58s. His mass is 94kg. Determine Usein’s average power output during this sprint.

7. A 500.0W (output) drill drives a screw into a piece of wood in 0.86s. The screw is 6.00cm long, has a pitch of 3.00mm and a shaft diameter of 2.00mm.

a. Find the work done by the drill.

b. Find the average force applied by the drill

c. If the drill is 80% efficient, how much electrical energy is consumed?

8. A pile driver is used to pound large posts into the ground during construction. It is a very simple device in which a large mass is dropped onto the top of the post, driving it into the ground. The mass is 1.00x103kg and it is dropped from a height of 5.00m. Upon hitting the post it drives the post down 10.0cm in 0.050s before coming to rest.

a. How much work must be done to lift the mass up 5.00m?

b. How much kinetic energy does the mass have at the moment it impacts the post?

c. How much kinetic energy does the mass have when it at rest?

d. How much power did the post-strike dissipate?

9. A 2019 Nissan GT-R has a mass of 1780kg. The GT-R can brake from 96.6km/h (60mph) to zero in 28m.

a. How much heat is generated by the brakes?

b. What is the power of the brakes?

c. Assuming that the 2 front brakes provide 70% of the stopping power, what is the average force provided by each of the four brakes?

10. a. How much electrical energy is consumed by a 100.0W light bulb in 1.00h if the efficiency is 40.0%?

b. How much light is produced by a 100.0W light bulb in 1.00h if the efficiency is 40.0%?

c. How much heat and sound is produced by a 100.0W light bulb in 1.0h if the efficiency is 40.0%?

11. Usein Bolt can run 100.0m in 9.58s. His mass is 94kg. Determine Usein’s average power output during this sprint.